

Remarks

Claims 1-18 and 20 are currently under examination in the application. Claims 1-18 and 20 are rejected. Reconsideration of claims 1-18 and 20 is respectfully requested.

Amended Claims

Claim 1 is amended by the insertion of the word "variable" and the sentence "adjustable from below to above the duration of a packet". These amendments add the limitation that the electronic buffer unit allows a variable delay of packets, which is adjustable from below to above the duration of a packet, i.e., it is not dependent on packets length such as a time slot system. Further, by the insertion of the words "ranges of" it is clarified that packets are assigned to delay queues depending on both the ranges of the queues and the packet length. In addition, by the insertion of the words "the moment", it is clarified that data packets are scheduled to outputs the moment at least two wavelengths are vacant.

Claim 13 is amended to add limitations and to clarify the method. The following text is deleted "communicating dataflow to the buffer, and reorganizing the data by assigning data packets according to length to different buffer queues and scheduling outbound data from the buffer unit when a predefined number, being at least two, of wavelengths leading to a buffered output destination being monitored to be vacant,".

Claim 13 is amended by insertion of the following text "switching data packets arriving at the switch inputs directly to the switch outputs when a predefined number, being at least one, of wavelengths being monitored, is

vacant,". Support for this text is found in paragraph [0004] lines 4-7 and paragraph [0023] lines 9-27.

Further, claim 13 is amended by insertion of the following text "communicating data packets arriving at the switch inputs directly to the buffer unit, if none wavelengths are vacant, and reorganizing the data by assigning data packets according to ranges of length to different buffer queues,". Support for this text is found in Figure 1, paragraph [0007] lines 2-11 and paragraph [0023] lines 9-27.

Furthermore, claim 13 is amended by insertion of the following text "scheduling outbound data packets from the buffer unit to the switch input the moment when a predefined number, being at least two, of wavelengths leading to a switch output destination being monitored to be vacant,". Support for this text is found in Figure 1, paragraph [0022] lines 5-8 and paragraph [0023] lines 9-27.

Claim 20 is amended from being dependent on claim 19 to be dependent on claim 13.

Claim Objections

As requested, the informality in claim 20 is corrected. Claim 20 now depends on claim 13.

Claim Rejections - 35 U.S.C 103

Claims 1-3, 5, 6, 8-10, 13-15, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Guild (US 2004/0151171) and Ge (US 6,819,870).

A review of the Guild publication versus the application gives the following result.

Guild, in paragraph [0009], describes a system with the aim of enhancing transmission efficiency of an all-optical

network, as well as to minimize the variation in the arrival times of transmitted packets of data.

Furthermore, as stated in paragraph [0013], Guild aims at achieving a simple time-slotted operation for each wavelength channel. For achieving time-slotted operation, the duration of the time-slot must correspond to the length of the packets. Hence, for achieving this for variable packet-length systems, Guild is sorting packets into streams according to their packet-length so that each stream consists of fixed length packets, as described in paragraph [0014]. Then, according to paragraph [0020] and Figure 1, each stream, or wavelength, consists of packets in time-slots, which are slots of a fixed duration. This results in, as mentioned in paragraph [0021], a reduction of required number of optical buffers at optical routing processing points within the network, because fixed length fiber delay lines buffers fixed length packets efficiently.

For sorting packets into queues and onto wavelengths and for resolving contention, Fiber delay lines are employed as illustrated in Figure 2.

By contrast, the application describes a fundamentally different approach, with the purpose of achieving another goal, than what is described in Guild.

First of all, the application does not aim at reducing the variation in arrival time of transmitted packets like Guild. It lets some packets bypass, while others are delayed in an electronic buffer, the variation in delay between packets is increased.

Secondly, the application does not aim at a time-slotted operation like Guild, because electronic buffers are applied which does not benefit of time-slotted operation in the same way as Fiber Delay Lines. This is because electronic buffers allow a variable delay of packets, and

furthermore that packets may be picked out of the buffer, independently of fixed time-slots as for Fiber delay lines. Hence, rather than sorting packets according to distinct packet lengths into queues for the purpose of achieving fixed length of the packets within a wavelength, as described in Guild, the application sorts packets into queues according to packet length ranges, and not distinct lengths as mentioned in Guild, allowing scheduling packets of any length onto any wavelength.

The application aims at reducing the number of electronic buffer interfaces, and the required capacity of the electronic buffer, rather than reducing the required number of optical buffers as described in like Guild. For achieving this goal which is different from Guild, a different approach is taken. The application minimizes the number of packets being buffered, by maximizing the number of packets being bypassed. This is achieved by always letting at least one switch output wavelength being vacant for bypassing packets. Hence, buffered packets are not allowed to be scheduled before at least two output wavelengths at the switch are vacant. This is opposite to Guild, which schedules a packet from the queues of fixed length packets to their corresponding wavelengths, whenever the corresponding wavelength is available.

Furthermore, for sorting packets into queues and allowing a variable delay of the packets, electronic buffers are applied, which is a different solution than Guild.

Claim 1

Regarding claim 1, the Guild reference in Figure 2, paragraph [0022] lines 1-11, paragraph [0010] lines 8-10 and paragraph [0020] lines 1-14 teaches that different streams of packets enters the input interface of the switch and are

phase aligned and synchronized. In the matrix of the switch, the packets are switched to different ports to the output interface.

In Guild, delay-lines are applied for solving the contention resolution. Contention occurs when two packets of the same size is scheduled for simultaneously arriving at the same output. Each of the packets will then be assigned to two separate delay-lines, each of the delay-lines having different delays. This allows the contention to be resolved by letting a first packet bypass a second packet before being scheduled to the output interface. At the output interface the packets are wavelength-converted resulting in wavelengths with packets of the same size. This is a different scheduling system than claimed by Applicant's claim 1. The Applicant in claim 1 teaches that a buffer unit with electronic delays is applied for solving the contention resolution. This allows the packets to stay in the buffer until a given number of wavelengths leading to the buffered packets destination are vacant.

Therefore, in Guild, it is the statistical arrival pattern of the packets that decides the distribution to the different delay lines/queues. While in claim 1 it is simply the length of the packet, and the range set for each queue, that decides which buffer delay queue it is sorted in. Claim 1 has now been amended accordingly.

Furthermore, Guild in paragraph [0020] lines 1-17 teaches that the system will assign a packet of a given size to a wavelength as soon as the wavelength associated with the packet of the given size is vacant. There is no description stating that there is a requirement that packets are not scheduled before more than one wavelength is vacant. The requirement exists to reduce contention in the switch and to reduce packet loss ratio to a minimum. Therefore,

the system of Guild is principally different from what is claimed in claim 1, where at least two wavelengths must be vacant before a packet is scheduled.

In addition, the mechanism described by Guild assigns packets to fixed delays at the moment the packets are arriving. This is fundamentally different from the approach described in the application. In the application, packets are stored in an electronic queue where the packets may be picked out at any moment, more specifically, when meeting the condition of more than one vacant wavelength. See paragraph [0025] lines 1-16, and more specific lines 15-16, in the application. Claim 1 has now been amended accordingly.

The Ge reference, column 5, lines 26-36, column 8, lines 6-23 and column 3, lines 34-37 describes a system for sorting packets according to length before scheduling these packets onto a wavelength in a Fiber Delay Line (FDL). The Ge system will try to schedule the shortest packets first. If only a single wavelength is vacant, the packet will be scheduled to the FDL.

This is fundamentally different from claim 1 in the application. In the application, packets are scheduled to the switch and further into the network, while in Ge packets are scheduled to FDL's and also processed at the output of the FDL.

Furthermore, in the application, the queues with packets containing different ranges of packet sizes have different conditions, than the queues in Ge, which must be met before packets are scheduled from the queues. In claim 1 in the application, a number of wavelengths defined for each of the queues, greater than one, must be vacant before a packet can be scheduled from a specific queue.

Claim 1 is amended to add limitations and to clarify the arrangement. Applicant therefore respectfully asks for reconsideration of claim 1 as it is considered to be allowable.

Claim 2

Regarding claim 2, Applicant acknowledges that the switch of Guild has information about which wavelengths are available, for the purpose of scheduling a packet to a wavelength from a dedicated queue. However, it is not correct that Guild monitors for detecting the number of vacant wavelengths.

In the application, the number of vacant wavelengths is counted through monitoring. Guild does not describe monitoring of wavelengths or any type of monitoring. Monitoring of output-wavelengths is not required in Guild, since the availability of a wavelength is given from previous events. In other words, if the switch schedules a packet onto a wavelength, it will know when the wavelength becomes available again. This information is given from the length of the packet which is already known to the switch.

In the application, the length of the packets switched for bypassing the buffer is not known. The output wavelengths are therefore monitored to find out when they become available.

Claim 2 is therefore allowable.

Claim 5

Regarding claim 5, it is pointed out that Guild in paragraph [0020] teaches that the buffer unit has inputs with data originating from lines external to the switch. This is not correct, since Guild is specifying inputs to the

input interface section of the switch, i.e., they are internal. This is also shown in Figure 2 in Guild.

In the application, claim 5 is specifying inputs to the buffer section directly of the switch and this is significantly different.

Claim 5 is therefore allowable.

Claim 6

Regarding claim 6, it depends on allowable claim 5 and is therefore allowable.

Claim 8

Regarding claim 8, Guild in paragraph [0020] line 7 teaches that the network is shown to be an optical packet switched network.

However, claim 8 specifies a number of other types of network not known to Guild, such as optical bursts switched network, electronic packet switched network, WDM network, and electronic bursts switched network.

Furthermore, claim 8 depends on allowable claim 1 and is therefore allowable.

Claims 9-10

Regarding claim 10, Guild in paragraph [0022] specifies an optical packet switch with electronic control layer. This is obviously not an electronic switching unit. Electronic control is not the same as electronic switching. Furthermore, Guild in paragraph 0022, line 18 specifies an optical packet switch unit. Guild describes only one type of unit and that is optical switching with electronic control.

Referring to claim 9, the Applicant acknowledged that Guild described an optical packet switch unit. However, the

unit cannot be an electronic switching unit and an optical packet switch unit simultaneously.

Claims 9 and 10 are dependent on allowable claim 5 and are thus allowable.

Claim 13

Regarding claim 13, the discussion of the switch of independent claim 1 applies as well to the method of claim 13.

Claim 13 rejection is based on that the Guild reference in Figure 2, paragraph [0022] lines 1-11, paragraph [0010] lines 8-10 and paragraph [0020] lines 1-17 teaches that different streams of packets enters the input interface of the switch and are phase aligned and synchronized. In the matrix of the switch, the packets are switched to different ports to the output interface.

In Guild, delay-lines are applied for solving the contention resolution. Contention occurs when two packets of the same size are being scheduled and arrives at the same output simultaneously. Each of the packets will then be assigned to two separate delay-lines, each of the delay-lines having different delays. This allows the contention to be resolved by letting a first packet bypass a second packet before being scheduled to the output interface. At the output interface the packets are wavelength-converted resulting in wavelengths with packets of the same size. This is a different scheduling system than claimed by Applicant's claim 13. The Applicant in claim 13 teaches that a buffer unit with electronic delays is applied for solving the contention resolution. This allows the packets to stay in the buffer until a given number of wavelengths leading to the buffered packets destination are vacant.

Therefore, in Guild, it is the statistical arrival pattern of the packets that decides the distribution to the different delay lines/queues. While in claim 13 it is simply the length of the packet that decides which buffer delay queue it is sorted in.

Furthermore, Guild in paragraph [0020] lines 1-17 teaches that the system will assign a packet of a given size to a wavelength as soon as the wavelength associated with the packet of the given size is vacant. There is no description stating that there is a requirement that packets are not scheduled before more than one wavelength is vacant. The requirement exists to reduce contention in the switch and to reduce packet loss ratio to a minimum. Therefore, the system of Guild is principally different from what is claimed in claim 13, where at least two output wavelengths must be vacant before a packet is scheduled.

In addition, the mechanism described by Guild assigns packets to fixed delays at the moment the packets are arriving. This is fundamentally different from the approach described in the application. In the application, packets are stored in an electronic queue where the packets may be picked out at any moment, more specifically, when meeting the condition of more than one vacant wavelength. See paragraph [0025] lines 1-16, and more specific lines 15-16, in the application.

The Ge reference, column 5, lines 26-36, column 8, lines 6-23 and column 3, lines 34-37 describes a system for sorting packets according to length before scheduling these packets onto a wavelength in a Fiber Delay Line (FDL). The Ge system will try to schedule the shortest packets first. If only a single wavelength is vacant, the packet will be scheduled to the FDL.

This is fundamentally different from claim 13 in the application. In the application, packets are scheduled to the switch and further into the network, while in Ge packets are scheduled to FDL's and also processed at the output of the FDL.

Furthermore, in the application, the queues with packets containing different ranges of packet sizes have different conditions, than the queues in Ge, which must be met before packets are scheduled from the queues. In claim 13 in the application, a number of wavelengths defined for each of the queues, higher than one, must be vacant before a packet can be scheduled from a specific queue.

Claim 13 is amended to add limitations and to clarify the method. Applicant therefore respectfully asks for reconsideration of claim 13 as it is considered to be allowable.

Claim 14

Regarding claim 14, the discussion of the switch monitoring of dependent claim 2 applies as well to the method of dependent claim 14. The Applicant acknowledges that the switch of Guild has information about which wavelengths are available, for the purpose of scheduling a packet to a wavelength from a dedicated queue. However, it is not correct that Guild monitors for detecting the number of vacant wavelengths.

In the application, the number of vacant wavelengths is counted through monitoring. Guild does not describe monitoring of wavelengths or any type of monitoring. Monitoring of output-wavelengths is not required in Guild, since the availability of a wavelength is given from previous events. In other words, if the switch schedules a packet onto a wavelength, it will know when the wavelength

becomes available again. This information is given from the length of the packet which is already known to the switch, due to the sorting of packets.

Furthermore, in the application, the length of the packets switched for bypassing the buffer is not known. The output wavelengths are therefore monitored to find out when they become available.

Claim 14 is therefore allowable.

Claim 15

Regarding claim 15, Guild teaches buffering data packets into a number of queues according to parameters of the data packets. The Applicant agrees, however claim 15 is dependent on allowable claim 13 and is thus allowable.

Claim 20

Regarding claim 20, Guild in paragraph [0020] - [0023] teaches associating a particular wavelength for a data stream of a particular packet length. In the application, claim 20 comprises the possibility to have multiple vacant wavelengths specific to each queue or data stream of a particular packet length.

Claim 20 is therefore allowable.

Claims 3-4 and 16-18

Claims 3-4 and 16-18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Guild and Ge further in view of Ohba. Applicant acknowledges that Ohba teaches classifying data packets by packet length, to suppress the burstiness of traffic and improve fairness characteristics.

Regarding claims 3-4, as claim 3 depends from allowable claim 1 and as claim 4 depends from claim 3, claims 3-4 are thus allowable.

Regarding claims 16-18 as claim 16, 17 and 18 depends from allowable claim 13, claims 16-18 are thus allowable.

Claims 7 and 11-12

Claims 7 and 11-12 were rejected under 35 U.S.C. §103(a) as being unpatentable over Guild and Ge, and further in view of Lee.

Regarding claim 7 and Lee in paragraph [0037] lines 3-6, paragraph [0019] line 6 and Figure 2 teaches buffer unit having input data from a switch. This is not correct, since Figure 2 and paragraph [0037] discusses only an optical router that has N input port and N output ports. A buffer unit is not mentioned in paragraph [0037]. Furthermore, paragraph [0019] mentions an electric buffer, but does not discuss the input of the buffer or the switch inputs.

Claim 7 is therefore allowable.

Regarding claim 11, the Applicant acknowledges that Guild teaches that the outputs signals of the switch are WDM. However, claim 11 is dependent on allowable claim 7 and is thus allowable.

Regarding claim 12, it depends on allowable claim 9 and is thus allowable.

Conclusion

Applicant requests Reconsideration and a Notice of Allowance.

The Examiner is requested to contact the undersigned attorney prior to an Office action at 408-297-9733 between 9:00 AM and 5:00 PM PST.

You are authorized to charge any fee deficiency or credit any overpayment to Deposit Account No. 19-0590.

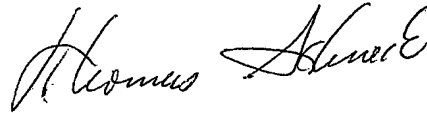
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Respectfully submitted,



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